

Objection to the Drawing

The drawing was objected to by the Examiner because "it is labeled 'Fig. 1', which should be deleted, since there is only a single drawing in the Application." (Office Action at page 2.) The drawing has been amended to delete the title "Fig. 1," as shown in the enclosed corrected drawing sheet. Accordingly, Applicants respectfully request that the objection to the drawing be withdrawn. In anticipation of the Examiner's approval of the amendment, this amendment is incorporated in the figure sent under separate cover to the draftsperson to correct informalities.

Objections to the Disclosure

The abstract of the disclosure was objected to because "it repeats information given in the title." (Office action at page 2.) As suggested by the Examiner in the telephone interview held on February 12, 2003, the abstract has been amended to delete the phrase "for the oxychlorination of ethylene to 1,2-dichloroethane" from the first line. Accordingly, Applicants respectfully request that the objection to the abstract be withdrawn.

The disclosure was also objected to because "it does not contain a Brief Description of the Drawing and because throughout it refers to the drawing as 'Figure 1', which should be changed to --the figure--." (Office action at page 3.) As set forth above, the specification has been amended to add a section entitled "Brief description of the drawing" and to change the language on page 7, line 26 from "Figure 1" to --the figure--. No new matter has been added by these amendments. Accordingly, Applicants respectfully request that the objections to the disclosure be withdrawn.

Rejections Under 35 U.S.C. §102(b)

Claims 16-30 were rejected as allegedly anticipated by Convers et al. (U.S. Pat. No. 4,460,699, "Convers"). Applicants respectfully traverse this rejection.

In order for a prior art reference to be anticipating, “every element of the claimed invention must be literally present, arranged as in the claim.” *Richardson v. Suzuki Motor Co., Ltd.*, 868 F.2d 1226, 1236 (Fed. Cir. 1989). Applicants respectfully request reconsideration of this rejection, as Convers fails to teach or even suggest every element of the claimed invention.

The office action asserts, *inter alia*, that Convers “discloses gamma alumina carrier, impregnation in several steps with aqueous solutions of the single reagent which is to be loaded onto the solid carrier and salts of copper, magnesium, and lithium, to produce a catalyst having a layer of catalyst carrier material containing magnesia carrying a catalytic agent containing copper.” (Office action at pages 3-4, internal citations omitted.) Applicants respectfully traverse this rejection and submit that the Convers reference does *not* fit the above description, but rather discloses a catalyst which does not even contain magnesium as part of the catalyst carrier when gamma alumina is used as the carrier material, and, when magnesia alumina is chosen instead as the catalyst carrier material, has a structure fundamentally different from that of the present invention.

Convers describes a catalyst having an impeded center (column 4, lines 35-38) followed by a layer of catalyst carrier material (column 4, lines 57-61) and, on the carrier material, a catalytic agent (column 5, lines 3-8) followed by an optional layer of metal salt modifier (column 5, lines 27-32 and claim 6). Convers discloses suitable materials for use as the catalyst carrier material, including gamma alumina and magnesia alumina (spinel). (Column 4, lines 57-61.) In the presently claimed invention, however, the catalyst carrier material is gamma alumina, which is then impregnated with a magnesium salt solution by dry impregnation to form a layer of magnesium aluminate on the surface of the support, which is then followed by a layer of catalytic agent. (Specification as originally filed at page 5, lines 14-27 and page 7, lines 11-18.)

As is apparent from its disclosure, the Convers reference teaches that when gamma alumina is chosen to be the catalyst carrier material, an active catalyst agent containing copper is then layered onto the gamma alumina and an optional layer containing a Group I or Group III metal salt may be deposited on top of the copper-

containing layer. (Convers at column 5 and claim 6.) This process results in a catalyst with layers of a different order than those of the present invention, and therefore, no anticipation exists. This distinction has been pointed out by Applicants in responses to previous office actions, and, following the telephonic interview of February 12, 2003, Applicants believe that this distinction is no longer disputed by the Examiner.

In the same interview, however, the Examiner further explained the reasons underlying his present office action, and stated that the present rejection under §102(b) is based on a belief that dry impregnation of gamma alumina support material with a magnesium salt solution as in the present invention results in a structure which is identical to the magnesia alumina (spinel) support described by Convers. As explained in detail below, Applicants respectfully submit that this interpretation is in error, because magnesia alumina (spinel) is a crystalline structure that is distinct and entirely different from the result of layering of magnesium salt solution onto gamma alumina as described by the current application.

Magnesia alumina, or "spinel", is a crystalline structure having a cubic close-packed octahedral structure in which magnesium cations occupy one-eighth of the tetrahedral holes and aluminum cations occupy one-half of the octahedral holes. The chemical formula for spinel is MgAl_2O_4 . (See, e.g., Rodgers, *Introduction to Coordination, Solid State, and Descriptive Inorganic Chemistry*, 1994, p. 182-183; Wells, *Structural Inorganic Chemistry*, 1984, p. 592-595.) In contrast, the catalyst of the present invention is formed by dry impregnation of gamma alumina with a magnesium salt solution, followed by addition of a layer containing the active copper-containing catalyst material. What results is not a spinel structure, but rather gamma alumina in which only the acidic centers on the alumina surface are modified, forming a layer of magnesium aluminate on the surface of the gamma alumina carrier, but leaving the underlying structure of the gamma alumina unchanged. (Specification at page 5, lines 23-27 and page 7, lines 11-18.) As described in the specification, the result is not a crystalline structure, but a *system* expressed by the formula $\text{Mg}/\text{Al}_2\text{O}_3$. (Specification at page 6, lines 11-15.) These differences are further demonstrated by the use of x-ray

diffraction spectra. A spinel structure has well-defined, narrow bands that result from its crystalline structure. Modified gamma alumina, however, has wide x-ray diffraction bands because it is not crystalline. Thus, a person having ordinary skill in the art would recognize that the magnesia alumina described by Convers as a possible catalyst support material is entirely different from the layered structure produced by impregnating gamma alumina with a magnesium salt solution as in the present invention.

In addition to the difference in their structures, magnesia alumina is much harder than gamma alumina. One of skill in the art would therefore recognize that although magnesia alumina might be suitable for use in a fixed bed reactor (to which Convers is limited), its hardness would lead to erosion and mechanical damage in a fluidized bed reactor, requiring frequent and expensive maintenance. Because the catalysts of the present invention are intended for use in either fixed *or* fluidized bed reactors (see specification at page 1, lines 6-8), persons having skill in the art would recognize that the use of magnesia alumina in the claimed catalysts would be inappropriate. In light of the foregoing distinctions, Applicants believe that the present invention is not anticipated by Convers and respectfully request withdrawal of the rejection of claims 16-30 under §102(b).

Applicants also submit that the catalysts of the present invention are not rendered obvious by Convers. As described above and in responses to previous office actions, the catalysts described by Convers are composed either of layers of a different order than the presently claimed catalyst or simply do not include a magnesium-containing layer. In contrast, the catalysts of the present invention have increased activity and improved performance because of the layers used and the order in which they are arranged. The catalyst layers are applied in the order specified above because the magnesium layer reacts with the surface of the γ -alumina support to form a magnesium aluminate coating, thus neutralizing acidic sites on the catalyst support surface and preventing an appreciable amount of copper from reacting with the γ -alumina. (Specification at page 5, lines 23-28 and page 7, lines 11-18.) If not for the layer of magnesium between the γ -alumina and the copper, the copper layer would interact with the γ -alumina to form

copper aluminate, which is *inactive* in oxychlorination, defeating the purpose of the invention. Instead, because the layers of the present invention are in the above-specified order, all or substantially all of the copper is available for catalyzing the oxychlorination reaction. (Specification at page 5, lines 23-27, page 6, lines 11-12 and 23-34, and page 7, lines 12-17.)

To establish a *prima facie* case of obviousness, “there must be some teaching, suggestion, or motivation in the prior art to make the specific combination that was made by the applicant.” *In re Oetiker*, 24 U.S.P.Q.2d 1443, 1445 (Fed. Cir. 1992). Such a teaching, suggestion, or motivation does not exist in this case. Convers does not disclose or suggest the use of a magnesium-containing layer directly on top of a gamma alumina catalyst support structure, let alone recognize the beneficial aspects of a catalyst formed in this manner. Accordingly, Applicants respectfully submit that the catalysts of the current invention are not rendered obvious by Convers.

In view of the foregoing statements, Applicants respectfully request that the objections and rejections set forth in the office action be reconsidered and withdrawn.

Conclusion

Applicants believe that the foregoing constitutes a full and complete response to the office action of record. Accordingly, an early and favorable Action is respectfully requested. Applicants invite the Examiner to contact the undersigned at 215-557-5966 to discuss any issues unresolved by this response.

Attached hereto is a marked-up version of the changes made to the claims by the current Response to Final Rejection. The attached page is captioned, “**Version With Markings to Show Changes Made.**”

Respectfully submitted,

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Version With Markings to Show Changes Made

In the Abstract:

The first sentence of the abstract has been amended as follows:

A catalyst [for the oxychlorination of ethylene to 1,2-dichloroethane] is prepared by impregnating a γ -alumina support with a magnesium salt, drying the product, and impregnating the product with a copper salt, preferably together with a lithium salt.

In the Specification:

The following paragraph has been added on page 7, following line 19:

Brief description of the drawing:

The attached figure depicts one embodiment of a fluid bed pilot plant in which the catalyst described herein may be used to convert ethylene to 1,2-dichloroethane. This diagram is illustrative in nature and is not intended to be limiting, as those of skill in the art will recognize that the catalyst of the current invention may be used in any number of reactor configurations, including both fixed- and fluidized-bed reactors.

On the same page, line 26 has been amended as follows:

All the experimental tests were carried out on the fluid bed pilot plant depicted in the figure [Fig. 1].